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# Alpha-GPC – An Overview

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## QUICK FACTS

- Also known as: Alpha-glycerolphosphorylcholine (GPC), L-alpha-glycerophosphocholine, glycerophosphocholine, L-alpha-glycerolphosphorylcholine, Choline alphoscerate
- Do not confuse with: Choline, DMAE, CDP-choline
- Is a form of:
  - Cholinergic – Refers to any compound that can increase levels of acetylcholine (ACh) or choline in the brain.
  - Nootropic – A Greek word meaning "towards the mind," refers to compounds that are both neurologically active, and directly or indirectly enhance cognitive potential.

## What is Alpha-GPC

An intermediate in phospholipid metabolism, alpha-GPC is a choline-containing molecule that, although found in a variety of foods (e.g., red and organ meat products, dairy products, wheat germ, etc.), appears to be metabolically active at higher amounts.<sup>1,2</sup> When evaluated based on serum values,<sup>3</sup> benefit from clinical interventions,<sup>4,5</sup> or potency by weight,<sup>2</sup> alpha-GPC appears to be the most effective choline precursor compared to choline and CDP-choline. Alpha-GPC has the added benefit that it is able to cross the blood-brain barrier and directly increase circulating ACh levels within the central nervous system (CNS).<sup>4</sup>

## How it Works

Alpha-GPC metabolizes into choline and glycerophosphate primarily within the GI tract and brain.<sup>3</sup> Choline is a precursor of the neurotransmitter acetylcholine (ACh), which has been shown to support a host of cognitive functions including memory formation and recall, learning ability, and concentration/focus.<sup>3,6</sup> The other byproduct of alpha-GPC is glycerophosphate, which supports several non-nootropic processes including healthy cell membrane integrity,<sup>7,8</sup> and healthy bone strength and resilience.<sup>†3</sup>

## Benefits and Effects Cognition and Memory

ACh has been shown to alter neuronal excitability, influence synaptic transmission, and induce synaptic plasticity throughout the body.<sup>1,4</sup> Among its many functions within the CNS, ACh supports the encoding of memory by enhancing the influence of both muscarinic and nicotinic ACh afferent (sensory feedforward) input to the prefrontal cortex, the region of the brain associated with short-term working memory. By enhancing this region, ACh supports the brain circuits to be more responsive to sensory stimuli, which allows retention after the original stimulus has ceased.<sup>1,9</sup>

Due to its ability to cross the blood-brain barrier and directly raise choline levels, alpha-GPC potentially plays a key role in neural plasticity and acetylcholinesterase inhibition.<sup>1,4,6</sup> In clinical studies, alpha-GPC has most frequently been evaluated for its ability to support cognitive function in the elderly with normal, age-related memory decline. At high doses (1,200 mg/d), alpha-GPC has been shown to significantly support cognitive abilities more so than choline and CDP-choline.<sup>1,4,10</sup>

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## Neural and Cellular Membrane Support

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Phosphatidylcholine (PC), also known as lecithin, is a ubiquitous, naturally-occurring phospholipid molecule. It's responsible for several critical functions throughout the body including maintaining cell structure, supporting nerve signaling, and serving as a precursor to ACh.<sup>9</sup>

Through its ability to increase phosphatidylcholine levels, alpha-GPC is understood to augment PC function as well as provide energy reserves for fatty acid metabolism.<sup>4,8</sup> Due to its cholinergic properties, alpha-GPC also appears to work in tandem with the pituitary gland to increase the production of somatotropin or HGH (human growth hormone), which stimulates cell growth, reproduction, and repair.<sup>11,12</sup> In animal models, alpha-GPC has demonstrated a monoaminergic profile (i.e., liberating or involving monoamines, such as serotonin or dopamine, in neural transmission), and supplementation has been shown to improve synaptic signaling, as well as support brain reorganization and functional recovery after injury.<sup>7</sup>

## Neurochemical Balance

Mood has a substantial impact on cognitive function. Multiple studies have shown that this interaction is mediated primarily by the prefrontal cortex and the cerebellum. Dysregulation within these regions are implicated in many mood-related disorders.<sup>†13</sup>

Although the research is limited, preliminary investigations demonstrate promising indications that choline plays in neurochemical balance. For example, in a large population-based study plasma choline concentration showed an inverse relationship with anxiety.<sup>14</sup> In addition, research has demonstrated alpha-GPC supplementation (150 mg/kg) to increase both dopamine and ACh concentrations in the frontal cortex and cerebellum of rats, which was not seen with an equal dose of choline from CDP-choline.<sup>7</sup>

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Choline and ACh levels are often viewed as reliable biomarkers of long-term cognitive health and neurochemical balance.<sup>1,3,6</sup> In fact, research has demonstrated the powerful nootropic properties of these molecules and their effects on neuronal excitability, synaptic transmission, synaptic plasticity, and coordinated firing of groups of neurons.<sup>1,4,9</sup> As a result, ACh changes the state of neuronal networks throughout the brain and modifies their response to internal and external inputs.<sup>†10</sup>

## Conclusion

In summary, alpha-glycerophosphocholine (alpha-GPC) is a water-soluble phospholipid metabolite that serves as a precursor for acetylcholine (ACh) and phosphatidylcholine (PC) biosynthesis throughout the body. Due to its activity profile and ability to cross the blood-brain barrier, it appears to be the most effective cholinergic compound, when compared to choline and CDP-choline, and is well tolerated. Research suggests that alpha-GPC supports many roles within the CNS including: sensory stimuli response, supporting learning and memory, and may play a role in healthy mood.<sup>†</sup> Owing to the provision of glycerophosphate, alpha-GPC also appears to support the structure and function of neural tissues and cellular membranes, and may play a role in supporting healthy brain function during injury recovery.<sup>†</sup>

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